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FERMENTATION OF RAFFINOSE BY SHIGELLAE

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The purpose of this paper is to report the results of studies on the fermentation of raffinose by relatively large numbers of cultures that belonged to the four Shigella subgroups and to the Escherichia coli group. The studies reported comprised a portion of an extensive reinvestigation of the biochemical reactions given by shigellae, including evaluations of the usefulness of several newer tests and methods in taxonomy. The results of the more comprehensive studies will be published elsewhere.

A total of 1263 Shigella cultures were tested in 0.5 per cent raffinose broth containing Andrade's indicator.[1] The strains employed were submitted to the laboratory during the last several years, but the majority were recently isolated. After inoculation the raffinose broth tubes were incubated at 37° C and observed daily for two weeks, after which they were examined at intervals of 3 days until a total of 30 days had elapsed.

The results of the tests are recorded in table 1. Cultures that belonged to the Shigella dysenteriae and Shigella boydii serotypes, including several provisional serotypes, did not

[1] A mimeographed outline of biochemical methods is available upon request.

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ferment raffinose, whereas the majority of Shigella flexneri, and all of Shigella sonnei strains utilized this substrate. Of 646 S. flexneri cultures tested, approximately 59 per cent fermented raffinose (20 per cent within 1 day, 39 per cent delayed) and 41 per cent did not. Only cultures of the mannitol negative variety of S. flexneri 4a and S. flexneri 6 (all biotypes) consistently failed to produce acid from this test substance. These two types constituted about 27 per cent of the 646 S. flexneri cultures tested. Of the remaining 475 S. flexneri strains, approximately 81 per cent utilized raffinose (27 per cent within 1 day, 54 per cent slowly) and 19 per cent did not.

Several S. sonnei strains were studied to determine whether their fermentation of raffinose was mutative. The cultures were inoculated onto agar plates and after incubation, 15 to 20 colonies from each plate were subcultured to individual tubes of raffinose broth. The progeny of each of the isolated colonies from the S. sonnei cultures studied produced acid from raffinose in approximately the same length of time. For example, the progeny from 18 of 19 colonies from one S. sonnei culture fermented this substance after 7 days' incubation while the nineteenth tube became acid after 8 days' incubation. The results of these limited studies indicated that fermentation of raffinose by S. sonnei strains may not be mutative in character. However, many additional S. sonnei cultures should be examined before definite conclusions are drawn. Also, S. flexneri strains should be studied in this regard.

In addition to the above-mentioned Shigella cultures, 344 E. coli strains were tested for raffinose fermentation. Seventy-six of these were aerogenic, motile biotypes and 268 were of the anaerogenic nonmotile biotypes commonly referred to as members of the Alkalescens-Dispar (A-D) group. Of the total E. coli cultures studied 58, or 17 per cent, fermented raffinose. Twenty-eight per cent of the 76 aerogenic, motile E. coli types and 14 per cent of the A-D group strains produced acid from raffinose. It was of interest to note that cultures belonging to A-D O antigen groups 1 (107 strains) and 2 (89 strains) failed to ferment raffinose.

The Shigella group or genus is differentiated from other Enterobacteriaceae by means of their biochemical reactions

and the group is divided into four subgroups or species by means of a combination of the biochemical and serological characteristics of the types contained in each subgroup. The results of the studies reported indicated that raffinose was of little value in distinguishing members of the Shigella group from anaerogenic, nonmotile E. coli cultures in general. However, the use of raffinose may be of assistance in the differentiation of A-D O1 and O2 strains from the majority of S. flexneri cultures, since strains belonging to these commonly occurring A-D O antigen groups did not utilize raffinose while the majority of S. flexneri cultures did so. Of more importance was the fact that within the Shigella group itself, raffinose was of considerable value in the biochemical differentiation of members of subgroups B (S. flexneri) and C (S. boydii), in the delineation or characterization of the four Shigella subgroups or species, and in the determination of the subgroup to which a culture may belong.

SUMMARY

Twelve hundred sixty-three cultures that belonged to the four Shigella subgroups or species and 344 Escherichia coli strains were tested for their ability to ferment raffinose. Members of subgroups A (Shigella dysenteriae) and C (Shigella boydii) did not utilize this substance whereas the majority of subgroup B (Shigella flexneri) and all of the subgroup D (Shigella sonnei) cultures did so. The majority of the E. coli strains tested failed to produce acid from raffinose.

The results indicated that the use of raffinose as a test substrate was of particular value in the biochemical differentiation of strains belonging to the S. flexneri and S. boydii subgroups and in the delineation or characterization of the four Shigella subgroups or species.

Table I. Fermentation of Raffinose by Shigellae

Subgroup		No. Tested	Positive 1 day	Positive Delayed	Negative
A					
S. dysenteriae	1	42	0	0	42
	2	83	0	0	83
	3	30	0	0	30
	4	12	0	0	12
	5	11	0	0	11
	6	2	0	0	2
	7	7	0	0	7
	8	13	0	0	13
Serotype	58	4	0	0	4
Serotype	3873-50	2	0	0	2
Serotype	2050-52	3	0	0	3
Total		209	0	0	209
B					
S. flexneri	1a	26	4	21 (3 to 5 days)	1
	1b	51	2	47 (2 to 14, majority in 2 days)	2
	2a	99	4	73 (2 to 28, majority in 2 or 3 days)	22
	2b	24	0	21 (3 to 12, majority in 4 or 5 days)	3
	3	98	64	20 (2 to 19, majority in 2 to 5 days)	14
	4a (+)	75	44	4 (2 to 3 days)	27
	4a (-)	36	0	0	36
	4b	16	4	11 (2 to 8, majority in 2 days)	1
	5	35	2	26 (2 to 10, majority in 3 or 4 days)	7
	6*	141	0	0	141
	X var.	8	2	5 (3 to 5 days)	1
	Y var.	30	4	20 (4 to 25, majority in 2 days)	6
	XY var.	7	0	6 (4 to 25, majority in 4 days)	1
Total		646	130	254	262
C					
S. boydii	1	18	0	0	18
	2	32	0	0	32
	3	8	0	0	8
	4	66	0	0	66
	5	5	0	0	5
	6	4	0	0	4
	7	41	0	0	41
	8	10	0	0	10
	9	10	0	0	10
	10	17	0	0	17
	11	34	0	0	34
Serotype	123	4	0	0	4
Serotype	425	10	0	0	10
Serotype	703	7	0	0	7
Serotype	2770-51	7	0	0	7
Total		273	0	0	273
D					
S. sonnei		135	1	134 (2 to 10 days, majority in 5 days)	0

(+) Mannitol positive variety
(-) Mannitol negative variety
* Includes all known biotypes

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SUPPLEMENT TO THE SIXTH REPORT ON THE SALMONELLA GROUP[1]

The Enterobacteriaceae Subcommittee of
the Nomenclature Committee of the International
Association of Microbiologists

List of Serotypes of Salmonella recognized by the Subcommittee since the Fifth Report in 1953[2]

Designation of Serotypes		Formula	
Salmonella aba	6,8	:i	:e,n,z_{15}
Salmonella accra	1,3,19	:b	:z_6
Salmonella adabraka	3,10	:z_4,z_{23}	:-
Salmonella adeoyo	16	:g,m	:-
Salmonella africana	4,12	:r(i)	:1,w
Salmonella agama	4,12	:i	:1,6
Collard and Montefiore (West Afric. Med. J. 1956, 5, 154). Sen and Collard (West Afric. Med. J. 1957, 6, 64).			
Salmonella agodi	35	:g,t	:-
Salmonella ahuza	43	:k	:1,5
Hirsch and Sapiro-Hirsch (Acta Med. Orient. 1955, 14, 298).			
Salmonella ajiobo	13,23	:z_4,z_{23}	:-
Salmonella akuafo	16	:y	:1,6
Salmonella alabama	9,12	:c	:e,n,z_{15}
Edwards, Johnson, McWhorter and Weed (Publ. Health Labor. 1954, 12, 15).			
Salmonella alagbon	6,8	:y	:1,7
Salmonella alexander	3,10	:z	:1,5
Lowe and Bokkenheuser (South Afric. J. Med. Sci. 1957, 22, 1).			
Salmonella altona	(8),20	:r(i)	:z_6
Rohde, Bischoff and Tiedje.			
Salmonella amsterdam	3,10	:g,m,s	:-
Salmonella amunigun	16	:a	:1,6
Salmonella angoda	30	:k	:e,n,x
Salmonella angola	1,9,12	:z	:z_6
Kampelmacher and Clarenburg (Antonie van Leeuwenhoek 1957, 23, 191).			

[1]Internatl. Bull. Bact. Nomen. and Tax. 8:25-70. 1958.
[2]Internatl. Bull. Bact. Nomen. and Tax. 4:47-94. 1954.

Salmonella ank 28 :k :e,n,z_{15}
Salmonella aqua 30 :k :1,6
Salmonella ardwick 6,7 :f,g :-
Salmonella azteca 4,5,12 :l,v :1,5
Olarte, Edwards, McWhorter and De La Torre.
Salmonella bambesa 9,12 :a :1,5
Le Minor (Annal. Inst. Pasteur 1956, 91, 664).
Salmonella baraqwanath 6,8 :m,t :1,5
Bokkenheuser and Toussaint (South Afric. Med. Sci. 1955, 20, 129).
Salmonella bere 47 :z_4,z_{23} :z_6
Salmonella bergen 47 :i :e,n,z_{15}
Kauffmann, Saervold, Kristiansen and Henriksen (Acta path. scand. 1955, 37, 492).
Salmonella berlin 17 :d :1,5
Salmonella blankenese 1,9,12 :b :z_6
Salmonella bleadon 17 :(f),g,t :-
Boycott, Taylor and Douglas (J. Path. and Bact. 1953, 65, 401). Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).
Salmonella blockley 6,8 :k :1,5
Friedman, Wassermann and Saphra (J. Bact. 1955, 70, 354).
Salmonella bloomfontein 6,7 :b :z_{42}
Salmonella bodjonegoro 30 :z_4,z_{24} :-
Erber and Utojo (Hemera Zoa 1954, 61, 171).
Salmonella boecker 6,14 :l,v :1,7
Boecker and Kauffmann (Acta path. scand. 1954, 34, 101).
Salmonella boksburg 40 :g,s :e,n
Morton, Koornhof and Bokkenheuser (South Afric. J. Med. Sci. 1957, 22, 3).
Salmonella bonn 6,7 :l,v :e,n,x
Seeliger, von Vietinghoff-Scheel and Kall (Z. Hyg. 1953, 137, 192).
Salmonella bracknell 13,23 :b :1,6
Salmonella bradford 4,12 :r :1,5
Salmonella brazzaville 6,7 :b :1,2
Le Minor, Merveille, Bascoulergue and Audebaud (Annal. Inst. Pasteur 1954, 87, 105).
Salmonella bristol 13,22 :z :1,7
Salmonella bronx 6,8 :c :1,6
Saphra, Wassermann and Friedman (J. Bact. 1955, 69, 477).
Salmonella bukuru 6,8 :b :1,w
Salmonella bulawayo (1),49 :z :1,5
Kauffmann and Deom (Acta path. scand. 1957, 40, 347).

Salmonella bury 4,12,27 :c :z_6
Stitt and Walsh (Internat. Bull. Bacter. Nomenclat. and Taxon. 1956, 6, 51).
Salmonella businga 6,7 :z :e,n,z_{15}
Van Oye and Lucasse (Annal. Inst. Pasteur 1957, 93, 791).
Salmonella buzu (1),6,14,25 :i :1,7
Salmonella carmel 17 :l,v :e,n,x
Hirsch, Hirsch and Sapiro-Hirsch (Acta Med. Orient. 1954, 13, 42).
Salmonella carno 1,3,19 :z :l,w
Salmonella chailey 6,8 :z_4,z_{23} :-
Salmonella charity 6,14 :d :e,n,x
Salmonella chingola 11 :e,h :1,2
Douglas, Taylor and Fairchild (South Afric. Med. J. 1953, 27, 404).
Salmonella chinovum 42 :b :1,5
Salmonella christiansborg 44 :z_4,z_{24} :-
Salmonella clifton 13,22 :z_{29} :1,5
Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).
Salmonella colindale 6,7 :r :1,7
Price and Holt (Internat. Bull. Bacter. Nomenclat. and Taxon. 1955, 5, 1).
Salmonella colombo 38 :y :1,6
Schmid, Velaudapillai and Niles (Annal. Inst. Pasteur 1954, 87, 106).
Salmonella curacao 6,8 :a :1,6
Edwards and McWhorter (Publ. Health Labor. 1954, 12, 17).
Salmonella dahlem 48 :k :e,n,z_{15}
Kauffmann, Hofmann and Platz (Zbl. Bakter. I Orig. 1956, 167, 94).
Salmonella dakar 28 :a :1,6
Darrasse and Le Minor (Bull. Soc. Path. exot. 1955, 48, 154).
Salmonella dalat 4,12,27 :y :e,n,x
Salmonella decatur 6,7 :c :1,5
Kauffmann, Edwards and McWhorter (Acta path. scand. 1955, 36, 568).
Salmonella degania 40 :z_4z_{24} :-
Hirsch and Sapiro-Hirsch (Acta Med. Orient. 1955, 14, 297).
Salmonella detroit 42 :z :1,5
Salmonella deversoir 45 :c :e,n,x
Watkins, Douglas and Taylor (Internat. Bull. Bacter. Nomenclat. and Taxon. 1955, 5, 5).

Salmonella djakarta 31 :z_4z_{24} :-
Erber and Kauffmann (Acta path. scand. 1957, 41, 79).
Salmonella djugu 6,7 :z_{10} :e,n,x
Kauffmann, van Oye and Schoetter (Acta path. scand. 1955, 37, 464).
Salmonella dugbe 45 :d :1,6
Salmonella duisburg 1,4,12,27 :d :e,n,z_{15}
Korell and Seeliger (Zbl. Bakter. I Orig. 1954, 161, 421).
Salmonella durham 13,23 :b :e,n,z_{15}
Salmonella edmonton 6,8 :l,v :e,n,z_{15}
Salmonella emmastad 38 :r :1,6
Edwards, Rutten and McWhorter (Antonie van Leeuwenhoek 1955, 21, 80).
Salmonella entebbe 1,4,12,27 :z :z_6
Salmonella ezra 28 :z :1,7
Hirsch and Sapiro-Hirsch (Acta Med. Orient. 1955, 14, 298).
Salmonella falkensee 3,10 :i :e,n,z_{15}
Hofmann and Pohl (Zbl. Bakter. I Orig. 1957, 167, 413).
Salmonella fanti 13,23 :z_{38} :-
Salmonella fortune 4,12,27 :z_{10} :z_6
Salmonella freetown 38 :y :1,5
Reid, Stitt and Taylor (Internat. Bull. Bacter. Nomenclat. and Taxon. 1956, 6, 61).
Salmonella fresno (9),46 :z_{38} :-
Edwards, Browne, McWhorter and Williams (Cornell Veterinarian 1954, 44, 259).
Salmonella friedenau 13,22 :d :1,6
Boecker, Richter and Winzer (Zbl. Bakter. I Orig. 1954, 161, 45),
Salmonella friedrichsfelde 28 :f,g :-
Hofmann and Herrier (Zbl. Bakter. I Orig.).
Salmonella frintrop 1,9,12 :b :1,5
Hoffmann, Linzenmeier and Kall (Zbl. Bakter. I Orig. 1956, 165, 78).
Salmonella fulica 4,5,12 :a :1,5
Salmonella galiema 6,7 :k :1,2
Van Oye, Ghysels and van Goethem (Annal. Inst. Pasteur).
Salmonella gambia 35 :i :e,n,z_{15}
Salmonella garoli 6,7 :i :1,6
Le Minor, Devignat and Schoetter (Annal. Inst. Pasteur 1953, 85, 804).

Salmonella gelsenkirchen 6,7 :l,v :z_6
Löns and Seeliger (Z. Hyg. 1957, 143, 566).
Salmonella germiston 6,8 :m,t :e,n,x
Bokkenheuser (South Afric. J. Med. Sci. 1955, 20, 5).
Salmonella ghana 21 :b :1,6
Salmonella gloucester 1,4,12,(27) :i :1,w
Waite, Taylor and Davey (Month. Bull. Min. Health Lond. 1957, 16, 14).
Salmonella godesberg 30 :g,m :-
Kauffmann, Lund and Seeliger (Acta path. scand. 1955, 36, 96).
Salmonella goerlitz 3,15 :e,h :1,2
Wildführ and Hudeman (Z. Hyg. 1955, 141, 129).
Salmonella gold coast 6,8 :r :1,w
Salmonella greenside 50 :z :e,n
Schrire, Kauffmann and Edwards (Acta path. scand. 1957, 41, 156).
Salmonella guildford 28 :k :1,2
Salmonella guinea 44 :z_{10} :-
Salmonella qwaai 21 :z_4z_{24} :-
Van Oye, Deom, Vercruysee and Fasseaux (Annal. Inst. Pasteur 1957, 92, 839).
Salmonella haarlem (9),46 :z :e,n,x
Vink, Clarenburg, De Novy and Bekker (Antonie van Leeuwenhoek 1955, 21, 367). Kauffmann (Acta path. scand. 1956, 38, 69).
Salmonella hadar 6,8 :z_{10} :e,n,x
Hirsch, Gerichter, Bredman, Lubling and Altman (Acta Med. Orient. 1954, 13, 41).
Salmonella haddon 16 :z_4z_{23} :-
Jonk and Schrire (South Afric. J. Med. Sci.).
Salmonella haelsingborg 6,7 :m,p,t,u :-
Kauffmann, Heilborn and Rutqvist (Acta path. scand. 1957, 41, 326).
Salmonella halmstad 3,15 :g,s,t :-
Heilborn and Rutqvist (Acta path. scand.).
Salmonella hamburg 1,9,12 :g,t :-
Rohde and Hofmann (Zbl. Bakter. I Orig. 1957, 168, 483).
Salmonella hamilton 3,15 :z_{27} :-
Salmonella hato 4,5,12 :g,m,s :-
Edwards, Rutten and McWhorter (Antonie van Leeuwenhoek 1955, 21, 80).

Salmonella hessarek 4,12 :a :1,5
Neel, Le Minor and Kaweh (Annal. Inst. Pasteur 1953, 85, 271).
Salmonella hillbrow 17 :b :e,n,z_{15}
Schrire (South Afric. J. Med. Sci. 1956, 21, 11).
Salmonella hindmarsh (8) :r :1,5
Atkinson
Salmonella hofit 39 :i :1,5
Salmonella hull 16 :b :1,2
Alexander, Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 117).
Salmonella huvudsta 3,10 :b :1,7
Alin and Malmberg (Acta path. scand. 1956, 39, 160).
Salmonella ibadan 13,22 :b :1,5
Stevenson (J. Path. and Bact. 1953, 66, 574).
Salmonella ilala 28 :k :1,5
Mackey (East Afric. Med. J. 1955, 32, 1).
Salmonella ilugun (1),3,10,(19) :z_4z_{23} :z_6
Salmonella indiana 1,4,12 :z :1,7
Hajna, Edwards, McWhorter and Damon (Publ. Health Labor. 1955, 13, 4).
Salmonella israel 9,12 :e,h :e,n,z_{15}
Edwards, Altman and McWhorter (Publ. Health Labor. 1953, 11, 141).
Salmonella jacksonville 16 :z_{29} :-
Galton, Edwards, Fife and Lewis (Publ. Health Labor. 1954, 12, 147).
Salmonella jaffna 1,9,12 :d :z_{35}
Schmid, Edwards, McWhorter and Velaudapillai (J. Path. and Bact. 1955, 69, 337).
Salmonella jamaica 9,12 :r :1,5
Salmonella janqwani 17 :a :1,5
Mackey (East Afric. Med. J. 1955, 32, 1).
Salmonella java 1,4,5,12 :b :[1,2]
Kauffmann (Acta path. scand. 1953, 33, 409).
Salmonella jedburgh 3,10 :z_{29} :-
Salmonella jericho 1,4,12,27 :c :e,n,z_{15}
Salmonella jos 1,4,12,27 :y :e,n,z_{15}
Salmonella kaduna 6,7 :c :e,n,z_{15}
Salmonella kalamu 4,12 :z_4z_{24} :-
Van Oye, Delcour and van Goethem (Annal. Inst. Pasteur 1955, 89, 587).
Salmonella kalina 3,10 :b :1,2
Van Oye, Ghysels and van Goethem (Annal. Inst. Pasteur).

Salmonella kaltenhausen 28 :b :z_6
Hofmann and Pohl (Zbl. Bakter. I Orig. 1955, 162, 543).
Salmonella kampala 1,42 :c :z_6
Salmonella kaneshie 1,42 :i :1,w
Salmonella kaolack 47 :z :1,6
Le Minor, Darrasse and Nazaud (Annal. Inst. Pasteur 1956, 91, 400).
Salmonella kapemba 9,12 :1,v :1,7
Kauffmann, Delville, Bouchaert and Ballion (Acta path. scand. 1954, 35, 307).
Salmonella karamoja 40 :z_{41} :1,2
Salmonella kenya 6,7 :1,z_{13} :e,n,x
Salmonella kiambu 4,12 :z :1,5
Salmonella kikoma 16 :y :e,n,x
Salmonella kilwa 4,12 :1,w :e,n,x
Mackey (East Afric. Med.J. 1955, 32, 1).
Salmonella kingabwa 43 :y :1,5
Kauffmann and Vandepitte (Acta path. scand. 1954, 35, 71).
Salmonella kinondoni 17 :a :e,n,x
Mackey (East Afric. Med. J. 1955, 32, 1).
Salmonella kintambo 13,23 :g,m,t :-
Van Oye, Ghysels and Glaudot (Annal. Inst. Pasteur).
Salmonella kisarawe 11 :k :e,n,x
Mackey (East Afric. Med. J. 1955, 32, 1).
Salmonella kokomlemle 39 :1,v :e,n,x
Salmonella korovi 38 :g,m,s :-
Kauffmann and van Oye (Acta path. scand. 1955, 36, 352).
Salmonella kotte 6,7 :b :z_{35}
Salmonella kunduchi 1,4,12,27 :1,z_{28} :1,2
Mackey (East Afric. Med. J. 1955, 32, 1).
Salmonella labadi 6,8 :d :z_6
Salmonella landau 30 :i :1,2
Günther and Hanser (Zbl. Bakter. I Orig. 1954, 161, 363).
Salmonella langford 28 :b :e,n,z_{15}
Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).
Salmonella lanka 3,15 :r :z_6
Salmonella lansing 38 :i :1,5
Salmonella larochelle 6,7 :e,h :1,2
Le Minor, Germain-Gourvest, Bourget and Dréan (Annal. Inst. Pasteur 1957, 92, 842).
Salmonella legon 4,12 :c :1,5

Salmonella leoben 28 :l,v :1,5
Roschka and Rotter (Mitt. oesterr. Sanitaetsverw. 1956, 57, 125).
Salmonella lethe 41 :g,t :-
Salmonella lille 6,7 :z_{38} :-
Kauffmann, Buttiaux and Gaumont (Acta path. scand. 1954, 34, 99).
Salmonella limete 1,4,12,27 :b :1,5
Kauffmann and Vandepitte (Acta path. scand. 1954, 34, 97).
Salmonella lindenburg 6,8 :i :1,2
Lempfrid (Zbl. Bakter I Orig. 1954, 160, 486).
Salmonella lisboa 16 :z_{10} :1,6
Figueiredo and Sampaio (J. Soc. Ci. Med. Lisboa 1954, 118, 162).
Salmonella lishabi (9),46 :z_{10} :1,7
Salmonella liverpool 1,3,19 :d :e,n,z_{15}
Salmonella livingstone 6,7 :d :l,w
Picton, Stirrup, Price and Taylor (J. Path. and Bact. 1953, 66, 310).
Salmonella llandoff 1,3,19 :z_{29} :-
Salmonella loenga 1,42 :z_{10} :z_6
Kauffmann and Bövre (Acta path. scand. 1957, 41, 159).
Salmonella luanshya 13,23 :g,s,(t) :-
Edwards, Nicewonger and Tarrant (Month. Bull. Min. Health Lond. 1957, 16, 90).
Salmonella luke 1,47 :g,m :-
Salmonella maqwa 21 :d :e,n,x
Salmonella mampeza (1),6,14,25 :i :1,5
Van Oye, Ghysels and van Goethem (Annal. Inst. Pasteur).
Salmonella manila 3,15 :z_{10} :1,5
Edwards, Kauffmann and McWhorter (Acta path. scand. 1954, 35, 67).
Salmonella mapo 6,8 :z_{1c} :1,5
Salmonella maracaibo 11 :l,v :1,5
Le Minor and Fossaert (Annal. Inst. Pasteur 1954, 87, 104).
Salmonella maritza see Salmonella salford var. maritza
Salmonella marylebone (9),46 :k :1,2
Boycott, Taylor and Douglas (J. Path. and Bact. 1953, 65, 401). Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).

Salmonella matadi 17 :k :e,n,x
Kauffmann and Vandepitte (Acta path. scand. 1954, 34, 97).
Salmonella merseyside 16 :g,t :1,5
Salmonella michigan 17 :l,v :1,5
Juenker and Caldwell (Publ. Health Labor. 1955, 13, 66).
Salmonella minneapolis (3),(15),34 :e,h :1,6
Edwards, Kauffmann and McWhorter (Acta path. scand. 1954, 35, 67).
Salmonella mishmar-haemek 1,13,23 :d :1,5
Silberstein, Gerichter and Reitler (Acta Med. Orient. 1954, 13, 40).
Salmonella mjimwema 1,9,12 :b :e,n,x
Mackey (East Afric. Med. J. 1955, 32, 1).
Salmonella mobeni 16 :g,s,(t) :-
Salmonella moëro 28 :b :1,5
Van Oye, Deom, Vercruysse and Fasseaux (Annal. Inst. Pasteur 1957, 92, 839).
Salmonella mokola 3,10 :y :1,7
Salmonella montgomery 11 :d,a :d,e,n,z_{15}
Edwards, Kauffmann and Huey (Acta path. scand. 1957, 41, 517).
Salmonella moroto 28 :z_{10} :1,w
Salmonella mundonobo 28 :d :1,7
Edwards, Rutten and McWhorter (Antonie van Leeuwenhoek 1955, 21, 80).
Salmonella naestved 1,9,12 :g,p,s :-
Salmonella nairobi 42 :r :-
Salmonella nashua 28 :l,v :e,n,z_{15}
Salmonella nchanga 3,10 :l,v :1,2
Douglas, Taylor and Fairchild (South Afric. Med. J. 1953, 27, 404).
Salmonella nchanga var. 3,10 :l,v :1,2
venusberg. Seeliger (Berl. u. Muench. Tieraerztl. Wschr. 1955, 69).
Salmonella negev 41 :z_{10} :1,2
Salmonella neukoelln 6,7 :l,z_{28} :e,n,z_{15}
Hofmann and Hentze (Zbl. Bakter. I Orig. 1955, 163, 572).
Salmonella new-haw 3,15 :e,h :1,5
Salmonella newlands 3,10 :e,h :e,n,x
Greening, Price and Taylor (Month. Bull. Min. Health Lond. 1953, 12, 89).
Salmonella nigeria 6,7 :r :1,6
Salmonella nima 28 :y :1,5

Salmonella nordenham 1,4,12,27 :z :e,n
Salmonella nottingham 16 :d :e,n,z_{15}
Ludlam, Taylor and Douglas (Month. Bull. Min. Health Lond. 1953, 12, 29).
Salmonella offa 41 :z_{38} :-
Salmonella okatie 13,23 :g,s,t :-
Edwards, Nicewonger and Tarrant (Month. Bull. Min. Health Lond. 1957, 16, 90).
Salmonella okefoko 3,10 :c :z_6
Salmonella oldenburg 16 :d :1,2
Seeliger, Seidenstücker and Sulzbacher (Z. Hyg. 1957, 144, 116).
Salmonella ona 28 :g,s,t :-
Salmonella os 9,12 :a :1,6
Salmonella osnabrueck 11 :1,z_{13},z_{28} :e,n,x
Schmidt-Lange, Joest and Möller (Zbl. Bakter. I Orig. 1957, 167, 562).
Salmonella pankow 3,15 :d :1,5
Salmonella patience 28 :d :e,n,z_{15}
Salmonella penarth 9,12 :z_{35} :z_6
Salmonella plymouth (9),46 :d :z_6
Salmonella portland 9,12 :z_{10} :1,5
Edwards and McWhorter (Internat. Bull. Bacter. Nomenclat. and Taxon. 1955, 5, 151).
Salmonella preston 1,4,12 :z :1,w
Salmonella quimbamba 47 :d :z_{39}
Salmonella rand 42 :z :e,n,z_{15}
Bleloch and Schrire
Salmonella redhill 11 :e,h :1,z_{13},z_{28}
Salmonella ridge 9,12 :c :z_6
Salmonella roan 38 :1,v :e,n,x
Salmonella roodepoort 13,22 :z_{10} :1,5
Bromfield and Bokkenheuser (South Afric. J. Med. Sci. 1956, 21, 73).
Salmonella rowbarton 16 :m,t :-
Boycott, Taylor and Douglas (J Path. and Bact. 1953, 65, 401). Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).
Salmonella ruiru 21 :y :e,n,x
Salmonella rutgers 3,10 :1,z_{40} :1,7
McWhorter and Edwards (Cornell Veterinarian 1956, 46, 509).
Salmonella saarbruecken 1,9,12 :a :1,7
Günther and Gaul (Zbl. Bakter. I Orig. 1954, 161, 544).

Salmonella salford 16 :l,v :e,n,x
var. maritza. Biochemical and serological variant of Salmonella salford. Wesselinoff and Nedeltschewa (Works of the Institute of Epidemiology and Microbiology, Sofia, 1953, 1, 195).
Salmonella saphra 16 :y :1,5
Salmonella sarajane 4,12,27 :d :e,n,x
Douglas and Taylor (Month. Bull. Min. Health, Lond. 1954, 13, 159).
Salmonella seattle 28 :a :e,n,x
Edwards and McWhorter (Internat. Bull. Bacter. Nomenclat. and Taxon. 1955, 5, 151).
Salmonella seegefeld 3,10 :r(i) :1,2
Hofmann and Pohl (Zbl. Bakter. I Orig. 1957, 167, 413).
Salmonella seremban 9,12 :i :1,5
Frisby and Hollos (J. Roy. Army Med. Corps 1954, 100, 55).
Salmonella shamba 16 :c :e,n,x
Salmonella sheffield 38 :c :1,5
Salmonella shipley (8),20 :b :e,n,z_{15}
Nicewonger, Taylor and Tomlinson.
Salmonella shoreditch (9),46 :r :e,n,z_{15}
Salmonella shubra 4,5,12 :z :1,2
Salmonella siegburg 6,14,18 :z_4z_{23} :-
Kauffmann, Edwards, Seeliger and Lund (Acta path. scand. 1955, 36, 353).
Salmonella soerenga 30 :i :1,w
Kauffmann and Bövre (Acta path. scand. 1957, 41, 159).
Salmonella solna 28 :a :1,5
Alin (Acta path. scand. 1956, 38, 71).
Salmonella souza 3,10 :d :e,n,x
Salmonella springs 40 :a :z_{39}
Bokkenheuser and Edwards (J. Path. and Bact. 1956, 72, 687).
Salmonella strasbourg (9),46 :d :1,7
Kauffmann and Lutz (Acta path. scand. 1955, 36, 179). Kauffmann (Acta path. scand. 1956, 38, 69).
Salmonella surat (1),6,14,25 :r(i) :e,n,z_{15}
Salmonella tamale (8),20 :z_{29} :-
Salmonella taunton 28 :k :e,n,x
Boycott, Taylor and Douglas (J. Path. and Bact. 1953, 65, 401). Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).
Salmonella teddington 4,12,27 :y :1,7

Salmonella teko	(1),6,14,25	:d	:e,n,z_{15}
Salmonella tel-el-kebir	13,23	:d	:e,n,z_{15}
Salmonella teshie	47	:l,z_{13},z_{28}	:e,n,z_{15}
Salmonella thiaroye	38	:e,h	:1,2

Le Minor, Le Minor and Darrasse (Annal. Inst. Pasteur 1956, 91, 935).

Salmonella tosamanga	6,7	:z	:1,5

Mackey (East Afric. Med.J. 1955, 32, 1).

Salmonella tshiongwe	6,8	:e,h	:e,n,z_{15}

Van Oye, Deom, Vercruysse and Fasseaux (Annal. Inst. Pasteur 1957, 92, 839).

Salmonella tudu	4,12	:z_{10}	:1,6
Salmonella tuebingen	3,15	:y	:1,2

Wundt and Klein (Z. Hyg. 1954, 140, 481).

Salmonella tunis	1,13,23	:y	:z_6

Le Minor, Huet and Dréan (Annal. Inst. Pasteur 1956, 91, 936).

Salmonella umbilo	28	:z_{10}	:e,n,x
Salmonella umhlali	6,7	:a	:1,6
Salmonella umhlatazana	35	:a	:e,n,z_{15}
Salmonella uno	6,8	:z_{29}	:-
Salmonella uphill	42	:b	:e,n,z_{15}

Boycott, Taylor and Douglas (J. Path. and Bact. 1953, 65, 401). Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).

Salmonella uppsala	4,12,27	:b	:1,7

Heilborn and Laurell (Acta path. scand. 1957, 40, 39).

Salmonella usumbura	18	:d	:1,7

Kauffmann and Fain (Acta path. scand. 1953, 33, 112).

Salmonella utah	6,8	:c	:1,5

Edwards and McWhorter (Publ. Health Labor. 1954, 12, 62).

Salmonella verity	17	:e,n,z_{15}	:1,6
Salmonella victoria	1,9,12	:l,w	:1,5
Salmonella victoriaborg	17	:c	:1,6
Salmonella vinohrady	28	:m,t	:-

Solar and Pechova (Csl. hyg., epid. a mikrobiol. 1953, 2, 154).

Salmonella vitkin	28	:l,v	:e,n,x

Hirsch and Sapiro-Hirsch (Acta Med. Orient. 1957, 16, 30).

Salmonella vom	4,12,27	:l,z_{13},z_{28}	:e,n,z_{15}
Salmonella wandsworth	39	:b	:1,2
Salmonella warragul	(1),6,14,25	:g,m	:-
Salmonella welikada	16	:l,v	:1,7

Salmonella wentworth	11	:z_{10}	:1,2
Salmonella westerstede	1,3,19	:1,z_{13}	:-
Salmonella weston	16	:e,h	:z_6

Boycott, Taylor and Douglas (J. Path. and Bact. 1953, 65, 401). Douglas and Taylor (Month. Bull. Min. Health Lond. 1954, 13, 159).

Salmonella westpark	3,10	:1,z_{28}	:e,n,x

Klein and Thur (Zbl. Bakter. I Orig. 1957, 168, 482).

Salmonella weybridge	3,10	:d	:z_6
Salmonella windhoek	45	:g,t	:1,5
Salmonella womba	4,12,27	:c	:1,7
Salmonella wuerzburg	9,12	:a	:1,5

Le Minor (Annal. Inst. Pasteur 1956, 91, 664).

Salmonella yalding	1,3,19	:r	:e,n,z_{15}
Salmonella yolo	35	:c	:-

Van Oye, Kauffmann and Delcour (Acta path. scand. 1955, 37, 528).

Salmonella zuerich	1,9,12	:c	:z_{39}

Fey, Kauffmann and Margadant (Acta path. scand. 1957, 41, 325).

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SUPPLEMENT TO THE FIFTH REPORT OF THE ENTEROBACTERIACEAE SUBCOMMITTEE ON THE SALMONELLA GROUP

The Enterobacteriaceae Subcommittee of
the Nomenclature Committee of the International
Association of Microbiologists

Salmonella alachua
(J. Bact. 1953, 66, 118).
Salmonella albuquerque
(Publ. Health Labor. 1954, 12, 141).
Salmonella berkeley
(Cornell Veterinarian 1953, 43, 572).
Salmonella harrisonburg
(Cornell Veterinarian 1953, 43, 110).
Salmonella ituri
(Acta path. scand. 1953, 32, 513).
Salmonella kasenyi
(Acta path. scand. 1953, 32, 513).
Salmonella krefeld
(Z. Hyg. 1953, 136, 379).
Salmonella nachshonim
(Acta path. scand. 1953, 33, 79).
Salmonella nagoya
(Jap. J. Med. Sci. and Biol. 1953, 6, 179).
Salmonella niarembe
(Acta path. scand. 1953, 32, 513).
Salmonella westhampton
(Cornell Veterinarian 1953, 43, 110).

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SUPPLEMENT TO THE THIRD REPORT ON THE SHIGELLA GROUP

The Enterobacteriaceae Subcommittee of
the Nomenclature Committee of the International
Association of Microbiological Societies[1]

In the 1953 Subcommittee Report (International Bulletin. 4:90-94. 1954), it was recommended that certain sub judice Shigella serotypes be considered for possible future addition to the Shigella schema. Since the 1953 Report was prepared these sub judice serotypes have been studied by various investigators and additional cultures of several have been isolated and studied. Therefore, it is recommended that certain of these serotypes be given serotype designations and added to the Shigella schema in the proper subgroup. Serotypes 58 (Cox) and 2050-52 may be added to subgroup A (Shigella dysenteriae) as serotypes 9 and 10, respectively, and serotypes 423, 425, 2770-51, and 703 may be added to subgroup C (Shigella boydii) as serotypes 12, 13, 14, and 15, respectively (see Shigella schema, appended). Further, it is recommended that the status of serotype 3873-50 and certain other serotypes remain sub judice for the present.

Three subserotypes of Shigella flexneri 3 are listed in the schema attached to the main body of the Third Report on the Shigella group as well as in that appended hereto. A characterization of these follows: subserotype 3a corresponds to the classical Z, which possesses group factors (subsidiary antigens) 6 and 7,8 but lacks the 3,4 (Y) component; subserotype 3b contains the 3,4 factor in addition to factors 6 and 7,8; and subserotype 3c possesses group factor 6, but lacks 3,4 and 7,8. All possess the same type or main antigen (III).

REFERENCES

Serotype 58 Cox, C.D. and G.I. Wallace 1948. J. Immunol. 60:465.

[1]Internatl. Bull. Bact. Nomen. and Tax. 8(1):25-70. 1958.

Serotypes 123, 3873-50, 2770-51 and 425	Ewing, W.H. and M.C. Hucks. 1952. J. Immunol. 69:575.
Serotype 703	Ewing, W.H., M.C. Hucks and M.W. Taylor. 1952. J. Bact. 63: 319.
Serotype 2050-52	Ewing, W.H. 1953. J. Bact. 66: 333.
Above serotypes (and certain sub judice serotypes)	Ewing, W. H., R. W. Reavis, and B.R. Davis. 1958. Canad. J. Microbiol., in press.

Shigella Taxonomy and Nomenclature

Subgroup	Serotype	Subserotype	Earlier Designations
A			
S. dysenteriae	1		S. shigae, Shiga-Kruse bacillus, etc.
	2		S. schmitzii, S. ambigua
	3		Q771
	4		Q1167
	5		Q1030
	6		Q454
	7		Q902
	8		Serotype 599-52
	9		Serotype 58
	10		Serotype 2050
B			
S. flexneri	1	1a	V
		1b	VZ
	2	2a	W
		2b	WX
	3	3a	Z
		3b	
		3c	
	4	4a	103
		4b	103Z
	5		P119
	6		Boyd 88, S. newcastle, Manchester bacillus
	X variant		X
	Y variant		Y
C			
S. boydii	1		170
	2		P288
	3		D1
	4		P274
	5		P143
	6		D19
	7		Lavington, type T, S. etousa
	8		Serotype 112
	9		Serotype 1296/7
	10		Serotype 430
	11		Serotype 34
	12		Serotype 123
	13		Serotype 425
	14		Serotype 2770-51
	15		Serotype 703
D			
S. sonnei			Sonne-Duval, Sonne III, etc.

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MICROBIOLOGICAL TAXA OF INFRASPECIFIC AND INFRASUBSPECIFIC RANK

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Microbiology, more particularly bacteriology, in common with all of biology, is confronted with the important problem of fixing upon a satisfactory method of naming taxa (taxonomic groups) below the rank of species. There are many such groups that have become of major economic and scientific importance, their names are frequently without adequate integration into the generally recognized nomenclatural codes. One example from bacteriology may be noted.

Quite satisfactory techniques have been developed for distinguishing and characterizing the several hundred strains of bacteria assignable to the genus (or group) Salmonella. Most of these strains are of sufficient importance in epidemiology that they should be named. Methods of labeling and cataloguing them have been developed, in large part due to the good work of the International Subcommittee on Enterobacteriaceae and to the establishment of laboratories to serve as "typing centers" primarily to serve the needs of epidemiologists. The practical question arises, are these groups of cultures, these differentiable strains of bacteria, to be regarded as taxa (taxonomic groups) in bacteriological nomenclature? Should they be included in the category of taxa that are being recognized as of lower rank than species or subspecies and that are now commonly designated (following the proposal of the zoologists) as of "infrasubspecific" rank? Are they "taxa"?

What is a taxon? The question has been quite satisfactorily answered from the standpoint of botany by Rickett (1958). He analyzes with some care the meaning of "taxon" and defines it as follows:

> ". . . a taxon is not an abstraction, nor does it include the categories of taxonomic thought. It is a taxonomic group or assemblage of plants or animals, having certain characteristics in common which we take as evidence of

genetic relationship, and possessed of some degree of objective reality. We can use the word wherever we can use 'taxonomic group' in referring to the characteristics, dynamics, distribution, or uses of such an assemblage."

This definition definitely includes as taxa all the infraspecific groups of the botanists and the infrasubspecific groups of the zoologists. The codes of nomenclature in all three branches of biology recognize taxa of the rank of subspecies, and all recognize more or less definitely taxa of rank lower than subspecies, though no two are in exact agreement as to the manner in which these groups are to be treated from the standpoint of taxonomy.

The three International Codes of Nomenclature may be classified from the standpoint of treatment of infraspecific and infrasubspecific taxa as follows:

A. Codes which recognize the coordinate status of the names of species and of subspecies.

1. Code which recognizes as valid (legitimate) only those names of infrasubspecific forms which are Latin or Latinized. . . . . International Code of Zoological Nomenclature

2. Code which recognizes as legitimate (valid) both names of infrasubspecific forms which are Latin or Latinized and those which are neither (vernacular names, formulae, etc.) . . . . . International Code of Nomenclature of Bacteria and Viruses

B. Code which does not recognize the coordinate nomenclatural status of names of species and subspecies. Two codes have been developed and recognized, distinguished by their different treatment of infrasubspecific forms.

1. Code that provides for Latin or Latinized names of infraspecific taxa to be applied to plants in nature (wild plants). . . . . International Code of Botanical Nomenclature

2. Code that provides for names of infrasubspecific taxa to be applied to cultivated plants; these names are not Latin or Latinized. . . . . International Code of Nomenclature for Cultivated Plants

Treatment of Infrasubspecific Names in Zoology

The International Code of Zoological Nomenclature places the names of taxa that are recognized into four groups based upon the number of words in a name. The names of subgenera and all higher taxa have one word, they are "uninominal"; the "designation" of a species has two words, is "binominal"; the "designation" of a subspecies has three words, is "trinominal"; the "name" of an infrasubspecific form when cited in relation to a species is "qualifiedly trinominal" in that there is interpolated after the specific name (specific epithet) a word indicating the status of the infrasubspecific form; the "scientific designation" of an infrasubspecific form cited in relation to a subspecies is "qualifiedly quadrinominal." In general, the rules that apply to specific and subspecific names are also applicable to the names of infrasubspecific forms, except that laws of Priority and Homonymy are to be applied "independently to the two classes: (1) specific and subspecific names and (2) infrasubspecific names."

The glossary of the Zoological Code defines an infrasubspecific form as any form of a species that is not to be considered a subspecies, such as different sexual forms, transition forms and all other minority forms but not including "aberrations." The examples given are "the dwarf first spring generation workers of bumble-bees; the worker major, the worker minor, the soldier castes of many species of ants."

The rule for citation of an infrasubspecific name resembles that for the citation of the name of a species, it consists of the binomen of the species or subspecies name followed by a comma and "an expression indicating the status attributed" to the form in question (e.g.: "form vern.," or "ab"), this in turn followed by the name (epithet) of the infrasubspecific form and the name of the author. The example given is "Rana esculenta marmorata, ab. x-us Black."

It is not clear whether it is the intent that this provision by the zoologists for recognition of infrasubspecific forms extends to the naming of strains of mutants as in Drosophila, or to the breeds of domestic animals and birds. Certainly there is no acceptance of vernacular names as names for infrasubspecific forms that have arisen under "cultivation." This is in marked contrast to the recognition of "fancy" names for cultivated plants as noted later.

Nor are there suggestions that parasitic forms showing little or no morphological differences but having marked host preferences should be named on the basis of the host affected.

Treatment of Infraspecific and Infrasubspecific Names in Botany

The Botanical Code differs from those of Zoology and of Bacteriology in recognition of a larger number of consecutively subordinate ranks, beginning with the species. They are Species, Subspecies, Variety (Varietas), Subvariety (Subvarietas), Form (Forma), and Subform (Subforma). All ranks of taxa below species are placed under the general heading of "infraspecific," there is no recognition of the zoological term infrasubspecific, although varieties, subvarieties, forms, and subforms may be regarded as included in this category.

An example of the full name of an infraspecific taxon in the genus Saxifraga is given as Saxifraga aizoon subvar. brevifolia forma multicaulis subforma surculosa Engler and Imscher.

The epithets used for subspecies and varieties are formed as are those of species. These epithets follow in order with the epithets of the highest rank first. The epithets of subvarieties and forms are similarly constructed, although there is provision that for the latter numbers or letters may be used to "facilitate their arrangement." A binary combination consisting of the name of the genus followed by the epithet of an infraspecific taxon is illegitimate, but a ternary combination consisting of the binary combination forming the name of a species followed by the epithet of the infraspecific taxon is legitimate providing

the rank of the infraspecific taxon is stated. The same epithet may be used for "infraspecific taxa within different species, even species of the same genus." In general, "two infraspecific taxa within the same species, even if they are of different rank, cannot bear the same infraspecific epithet unless their names are based upon the same type." The infraspecific names under this code are in general applied to wild plants, although plants brought into cultivation from the wild which differ in no fundamental way from the parent wild stocks bear the same names as are applied to the same infraspecific taxa in nature.

However, plants that arise "in cultivation through hybridization, mutation, or other processes which tend to establish recognizable differences from the parent stocks receive epithets, preferably in common language (i.e., fancy epithets), markedly different from the Latin epithets of species or varieties." For these an "International Code of Nomenclature for Cultivated Plants" has been formulated and adopted by the International Commission for the Nomenclature of Cultivated Plants of the International Union of Biological Sciences. The Commission charged with the development of this Code of Nomenclature for Cultivated Plants included three groups of members, one group representing agriculture, a second forestry, and a third horticulture. This Code states that it is important "that a precise, stable, and internationally accepted system should be available "for naming of cultivated plants." It makes clear that "the International Code of Botanical Nomenclature governs the use of scientific ("Latin") names for both cultivated and wild plants." The purpose of the Code is "to promote uniformity, accuracy, and fixity in the naming of agricultural, silvicultural, and horticultural cultivars (varieties) which are normally given fancy names," such as "the rose Peace." The common names (vernacular names) which are applied to genera and species such as "potato," "rye," "sweet cherry" are not regulated by this Code.

The Code authorizes the use of the term "cultivar" as interchangeable with the term "variety" as commonly applied to cultivated plants. Cultivar is defined as "an assemblage of cultivated individuals which are distinguished by any characters (morphological, physiological, cytological, chemical, or others) significant for the purposes of agriculture,

forestry, or horticulture, and which, when reproduced (sexually or asexually), retain their distinguishing features." There is insistence that "Registration of cultivar (variety) names is of the greatest importance for nomenclatural stability)." A distinction is drawn between the use of the term "variety" as used in this code and the term "varietas" as used in the International Bacteriological Code.

A cultivar may be any one of several kinds of unit:

a) A clone (cl.), defined as "consisting of uniform material derived from a single individual and propagated entirely by vegetative means," as by cuttings, grafts, etc.

b) A line, "consisting of a sexually reproducing population of uniform appearance, propagated by seeds or by spores, its stability maintained by selection to a standard."

c) "An assemblage of individuals (reproducing sexually or by apomixis) showing genetical differences but having one or more characteristics by which it can be differentiated from other cultivars (varieties)." As Medicago sativa 'Ranger'.

d) A uniform group which is a first generation hybrid (F_1) reconstituted on each occasion by crossing two or more breeding stocks maintained either by inbreeding or by clones. As maize US.13.

The designation of an improved selection of a cultivar by the use of the term "strain" is rejected. However, the use of the term "group" is authorized: "Within a species or interspecific hybrid which includes many cultivars (varieties), assemblages of similar cultivars (varieties) may be designated as groups."

The names of a cultivar given after 1 January 1959 must be a "fancy name," that is, one markedly different from a scientific name of Latin form. A cultivar name "directly attached to a scientific or common name, must be distinguished either by placing the abbreviation cv. before it, or typographically, as by enclosing it within single quotation marks."

Capital initial letters must be used for all words of a new cultivar name. The name of a cultivar must be attached directly or by implication "either to a scientific name or to a common name of the plant concerned, provided the common name is unambiguous." The name of a cultivar should consist preferably of one or two words, never more than three, with any symbol, letter or numeral counted as a word. Rules are laid down for the rejection of inadmissible names, for publication priority, and for rejection of names. The importance of registration of all cultivar names is emphasized and a list of the several organizations that have been set up for the registration of cultivar names in various fields is given. There is also an appendix which lists recommendations for the guidance of registration authorities.

Some botanists believe the International Code of Nomenclature for Cultivated Plants in some cases to be too narrow in its coverage. Hegnauer reports that in 1957 there was held in Wageningen, Holland, an International "Arbeitstagung über Arznei- und Nutzpflanzenforschung." Here it was proposed that the Code for cultivated plants be extended to cover the naming of wild plants showing no noteworthy morphological differences but distinguished by their production of chemicals of economic significance, often important from the standpoint of pharmacology. It was suggested that "chemical races" be recognized, the term "race" being used in the sense of an infraspecific related group. At this conference Tetenyi proposed that for designation of such races the prefix "chemo-" be used. Later (1958) he published an elaborated proposal for a supplementary nomenclature adapted to the expression of physiological-chemical phenomena, to the naming of "natural" as well as "artificial" races, to polyploids, to races morphologically alike but differing in the amount of the active material produced. The needs of botanists, chemists, horticulturists, and "selectionneurs" should be met. He proposed the recognition of several infraspecific categories for cultivated plants; chemoconvar (chcon.), chemocultigrex (chg.), and chemocultivar (chv.). For plants growing wild in nature which show "spontaneous" differences he proposes the categories chemovar (chvar.) and chemoforma (chf.) For example, he would distinguish six chemical races of Cinnamomum camphora Sieb. subsp. formosana Hirota by naming them respectively chvar. borneol; chvar. campher; chvar. cineol; chvar. linalool; chvar. safrol; and chvar. sesquiterpen. He would recognize

two chemoformae in the chvar. linalool as chf. 86 per cent and chf. 71 per cent. In the cultivated Cinchona ledgeriana Moens two chemocultigreges would be named, chg. chinidin and chg. cinchonidin.

Mansfield (1958) also notes the need for distinguishing plants on the basis of physiological characteristics, particularly those sibs that show no morphological differences. He states that Hegnauer has proposed the use of the term forma biochimica to correspond to the recognized forma specialis, and suggests that these terms are not very suitable as they consist of two words. He opposes the use of the term type as an infraspecific designation as it already has a definite meaning both in nomenclature and in morphology. He proposes the use of the term isovar (from isovarietas) for a physiological race as contrasted to varietas for a morphological race.

Lanjouw (1958) proposes that the separation between names of wild plants and those of cultivated plants be maintained, that "chemical strains or varieties formed in the wild should be treated as ordinary infraspecific units, they should be named, and the publication of the name should be accompanied by a Latin diagnosis." To follow this suggestion of Latinization of all the names of wild infraspecific plants distinguished on the bases of physiological and biochemical differences would involve very much practical difficulty. In the Latin descriptions many chemical compounds would need to be Latinized and declension and gender determined. The epithets of the infraspecific units might well appear in such forms as Cinnamomum camphora Sieb. subsp. formosana forma sesquiterpenificum (or var. linalooligenum).

Lanjouw would treat those strains that have been developed in the course of cultivation as "cultivars" to be given "fancy" names as prescribed in the International Code of Nomenclature for Cultivated Plants. Two difficulties at least would need to be resolved. A cultivated plant distinguished from others of the same species by the production of some definite chemical compound is not quite in the same category as a garden vegetable, a "fancy name" is not very suitable; one would hesitate to name a cultivar of a plant economically important as producing borneol as "cultivar 'Jones' Best'." Further, the several wild races of a species producing

different but related chemicals of economic significance would commonly be brought under cultivation, and new mutants or lines or clones developed under cultivation would have a different set of rules governing their naming than would the several strains first found wild. This could readily lead to confusion. However, Lanjouw concludes that these chemical (biochemical) and pharmaceutical characters need to be recognized and treated formally as they may prove to be of real value in taxonomy.

Treatment of Infraspecific and Infrasubspecific Names in Bacteriology

The Rules of the International Code of Nomenclature of the Bacteria and Viruses resemble those of Zoology in that specific and subspecific epithets (the specific and subspecific names of the zoologists) are coordinate nomenclaturally. Provision is also made for the recognition of taxa of infrasubspecific rank. The Bacteriological Rules differ from those of Zoology in that under appropriate circumstances either Latinized or vernacular words or formulae or other designations may be used as infrasubspecific epithets. Further, the Bacteriological Code makes provision for infrasubspecific names under the heading of "Recommendations" rather than "Rules." In Bacteriology there is not the distinct separation of the nomenclature of infrasubspecific forms that are found "wild" and that "are developed under cultivation," distinctions to be found in the two Botanical Codes. Further, in bacteriology infrasubspecific epithets may be either Latinized or vernacular or given as formulae.

A careful study should be made of the status of the names given to the infrasubspecific forms in Bacteriology by the Judicial Commission and the International Committee on Bacteriological Nomenclature at the Stockholm (1958) meeting. It is believed that there has been sufficient accumulation of basic data to permit the formulation of rules which would go far in the elimination of what seems to be unnecessary confusion in the nomenclature of so many strains of bacteria that are of pharmaceutical, medical, sanitary, technical, analytical, biochemical, genetic, antibiotic, physiological, or other importance. The need for agreement upon suitable rules for the naming of these strains is even more pressing than in the many other fields of biology.

Several categories of infraspecific epithets are recognized in the Bacteriological Code. Their definitions and uses should be appraised before an attempt is made to develop logical amendments to the Code that would seem to fit the peculiar needs of bacteriology. It is, of course, unfortunate that the three areas of biology should not have arrived at some greater degree of agreement in this rapidly developing field of biological nomenclature. Quite possibly the reconciliation of the three divergent approaches to the nomenclature of the infrasubspecific forms may be a matter that should be taken under advisement by the International Union of Biological Sciences. This organization in a sense has sponsored the recent revisions of all three codes of biological nomenclature, and might well take note of the impending chaos in what is essentially popular nomenclature because of the lack of coordination among the several Codes. A study of the problem from the standpoint of biology as a whole rather than from the points of view of the three divisions is desirable.

The terms commonly used to designate the rank of the infrasubspecific taxa in bacteriology are strain, biotype, serotype, phagotype, morphotype, group, phase, forma specialis, stage, and state. Consideration should also be given to better differentiation of races or strains of bacteria that are important because they produce different chemical compounds or substances of pharmaceutical significance such as antibiotics, likewise those that as the result of mutation have lost the ability to synthesize certain needed nutrients, and which have become important in qualitative and quantitative analyses for these compounds.

The Bacteriological Code states that subdivisions of species (other than subspecies) and subdivisions of subspecies are to be given names (better, epithets) to follow the name of the species or subspecies. These epithets may be words in the vernacular or in Latin or words in Latinized form, or they may be names of persons or of places; they may be letters or numerals separately or combined into descriptive formulae, or they may be numbers or other designations used by Type Culture Collections to identify the different strains maintained.

It is proposed that the Recommendations that now govern

the use of infrasubspecific names and epithets be modified where advisable into Rules and emended Recommendations. It is suggested that "Rule 8 Infrasubspecific Subdivisions" be emended to make mandatory certain treatments of the names of infrasubspecific taxa. The following suggestions are wholly tentative and intended to assist the members of the Judicial Commission and the International Committee on Bacteriological Nomenclature at their meetings at the Stockholm (1958) Congress.

1. The terms used to designate the rank of the several infrasubspecific taxa in bacteriology should be evaluated and more accurately defined. The terms listed in the International Code of Nomenclature and Taxonomy are strain, type, biotype, serotype, phagotype, morphotype, group, phase, forma specialis, stage, and state. Are all these terms needed? The terminology of the International Code of Nomenclature for Cultivated Plants should be studied for suggestions as to possible useful adaptations to bacteriology. Such designations as cultivar, chemovar, chemocultivar, chemoforma may have useful implications in some bacterial taxa.

2. Infrasubspecific nomenclature has already been used more or less extensively in certain genera and families of bacteria. To what extent is it desirable or necessaryto fix the terms used for designating the infrasubspecific ranks? In some cases within a single species several infrasubspecific groupingshave been used. One may group the strains of Staphylococcus on the basis of bacteriophage susceptibility (i.e., as phagotypes), or on the basis of virulence, or on the basis of serology(i.e. as serotypes). The same strain may bear more than one infrasubspecific name. If such duplicate cataloguing is desirable (probably it is) the implications should be clear.

3. National and international committees involved in studies of special groups of bacteria (usually of genera or families), perhaps specialists in particular groups, might well develop proposals for the standardization of the designation of names of infrasubspecific categories. Among the genera and other taxa that might receive consideration are the following:

Pseudomonas. To what extent might use of infrasubspecific names be used for host preference, virulence, phage susceptibility, pigment production, etc.

Xanthomonas. Host preferences, etc.

Acetobacter. Chemical final products, morphotypes.

Vibrio. Serotypes, etc.

Rhizobium. Forma speciales (host preferences), phagotypes, virulence.

Escherichia. Biotypes, serotypes, phases, phagotypes, virulence, etc. Similarly for the other genera of Enterobacteriaceae; Aerobacter, Klebsiella, Serratia, Proteus, Salmonella, Shigella.

Pasteurella. Biotypes, host specificity, serotypes, etc.

Micrococcus and Staphylococcus. Biotypes, serotypes, virulence, phagotypes.

Neisseria. Biotypes, serotypes, etc.

Diplococcus. Biotypes, serotypes, etc.

Streptococcus. Biotypes, serotypes, virulence, phagotypes, etc.

Lactobacillus. Biotypes, serotypes, etc.

Propionibacterium. Biotypes.

Corynebacterium. Biotypes, phagotypes, morphotypes, etc.

Bacillus. Morphotypes, biotypes, phagotypes, etc.

Clostridium. Morphotypes, biotypes, phagotypes, etc.

The several genera of the Mycobacteriaceae, Actinomycetaceae, and Streptomycetaceae: Mycobacterium, Nocardia, Actinomyces, Streptomyces, Micromorospora, Morphotypes, virulence, serotypes, antibiotic production, phagotypes, etc.

Treponema. Morphotypes, host specificity, serotypes, etc.

Leptospira. Serotypes, host specificity.

Rickettsia. Host specificity, vector specificity, serotypes.

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OBSERVATIONS ON THE GENUS AEROBACTER WITH A DESCRIPTION OF TWO SPECIES

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Within recent years there has been renewed discussion concerning the taxonomy and nomenclature of organisms classified in the genera Klebsiella and Aerobacter. It has been pointed out repeatedly (1, 2, 3, 4, 5) that the majority of nonmotile strains isolated from diverse sources, and often referred to as Aerobacter aerogenes, were indistinguishable from typical Klebsiella cultures and should be classified in the genus Klebsiella. This view is reaffirmed. There has been a lack of unanimity of opinion as to how the related motile forms should be designated. Kauffmann (6) pointed out that "Aerobacter aerogenes" cultures actually belonged to the species Klebsiella pneumoniae and proposed that the species Aerobacter aerogenes and the genus Aerobacter be dropped. To provide a place for the classification of the motile forms, Kauffmann reintroduced the genus Cloaca of Castellani and Chalmers (7) and later (8) employed the term Cloaca cloacae of the same authors. On the contrary, Edwards and Fife (9) and Edwards and Ewing (10) advocated redefinition of the genus Aerobacter as a motile genus and the adoption of Aerobacter cloacae as the type species. Skinner (11) pointed out that while a genus might be redefined, and thereby either broadened or narrowed, that it was contrary to the type concept to remove a type species from a genus and yet retain the generic name. He further pointed out that Beijerinck originally included both motile and nonmotile forms in A. aerogenes.

Recent work, in which additional biochemical tests were employed, now makes desirable a reassessment of the situation in regard to the genus Aerobacter. Brooke (12) found no motile cultures of the group which produced gas rapidly from glycerol and only one motile culture which fermented inositol promptly with production of gas. On the contrary, both

Edwards and Fife (9) and Hormaeche and Munilla (5) described motile cultures which promptly fermented both substances with gas production. Moeller (13, 14) pointed out the value of decarboxylase tests in the differentiation of the Klebsiella-Aerobacter group. A re-examination of cultures in our possession in the light of these findings has made it desirable to modify the conclusions of Edwards and Fife (9) in regard to nomenclature, with which Hormaeche and Munilla (5) concurred. Restudy of the cultures supports the view that the genus Klebsiella should include nonmotile cultures often referred to as Aerobacter aerogenes. These cultures ferment glycerol and inositol and, as shown by Moeller, give positive lysine decarboxylase tests but give negative results in tests for arginine dihydrolase and ornithine decarboxylase. On the contrary, motile forms largely fall into two groups which possess the following characteristics:

	A	B
Gas from glycerol	-	+
Gas from inositol	-	+
Lysine decarboxylase	-	+
Arginina dihydrolase	+	-
Ornithine decarboxylase	+	+

These groups correspond to the Cloaca A and Cloaca B of Hormaeche and Munilla. Instead of classifying all motile forms in one species as proposed by Edwards and Fife, it now seems desirable to divide the genus Aerobacter into two species: Aerobacter aerogenes (Cloaca B of Hormaeche and Munilla) and Aerobacter cloacae (Cloaca A of Hormaeche and Munilla). If this is done the genus would be composed of forms which typically are motile although one would expect that nonmotile variants exist and such variants have been observed.

Cowan (15) discussed the possibilities in regard to the nomenclature of coliform bacteria and the Editorial Board of the International Bulletin (16) formulated a number of draft proposals based upon that discussion. Of these draft proposals, the writers support draft proposals 3 and 4 which would conserve the genus Aerobacter Beijerinck 1900 and designate Aerobacter aerogenes (Kruse) Beijerinck as the type species. While Beijerinck (cited by Skinner, 11) included both motile and nonmotile forms in A. aerogenes, the writers would limit the species to typically motile forms with the

realization that nonmotile variants occur. The separation of the genera and species would not be based upon motility alone, but upon a combination of biochemical characteristics which have proven value in differentiation. The taxonomic position of a given strain should not be determined by the result of a single test but should be judged by the sum total of its known behavior. Nor would the writers necessarily limit the genus Aerobacter to two species although it is not wished to describe others at this time. Taxonomy is not static and later it may be necessary to emend the genus definition. However, at present we would define the genus Aerobacter as follows: Motile bacteria conforming to the definition of the family Enterobacteriaceae, fermenting glucose, lactose, and cellobiose with acid and gas production. Form two or more times as much carbon dioxide as hydrogen from glucose. Methyl red test negative, Voges-Proskauer test positive. Citric acid and salts of citric acid utilized as sole source of carbon. The KCN and ornithine decarboxylase tests are positive. Fail to produce gas promptly from insoluble starch. Nonmotile variants of otherwise typical cultures are known to occur. The type species is Aerobacter aerogenes (Kruse) Biejerinck 1900, emendavit.

It is not wished at this time to detail the numbers of cultures examined nor the numbers and characteristics of aberrant and intermediate strains found among them. These facts will be brought out in separate publications. At this time it is wished to emphasize that there are at least two well-defined species which the writers would include in the genus Aerobacter, A. aerogenes and A. cloacae. The typical biochemical behavior of these types is set forth below.* For the convenience of the reader, the typical biochemical behavior of Klebsiella pneumoniae is given for comparison since this is the Klebsiella species most closely related to the Aerobacter types and includes many cultures previously classified as Aerobacter aerogenes.

*Typical cultures have been deposited in the American Type Culture Collection, Washington, D.C. and the National Collection of Type Cultures, London, under the following numbers: Klebsiella pneumoniae, ATCC 13046; NCTC 10004; A. aerogenes, ATCC 13048, NCTC 10006; A. cloacae, ATCC 13047, NCTC 10005.

Biochemical Characteristics

	Klebsiella pneumoniae	Aerobacter aerogenes	Aerobacter cloacae
Gas from glucose	+	+	+
Lactose (acid)	+	+	+
Sucrose	+	+	+
Mannitol	+	+	+
Dulcitol	d	d	d
Salicin	+	+	+
Adonitol	+	d	d
Inositol (gas)*	+	+	-
Glycerol (gas)*	+	+	-
Rhamnose	+	+	+
Raffinose	+	+	+
Arabinose	+	+	+
Xylose	+	+	+
Sorbitol	+	+	+
Cellobiose (gas)*	+	+	+
Insoluble starch (gas)**	+	-	-
Indol	-	-	-
Methyl red	-	-	-
Voges-Proskauer	+	+	+
Ammonium citrate	+	+	+
Hydrogen sulfide	-	-	-
Urease***	+	-	-
Gelatin liquefaction	-	d	+
Growth in KCN medium	+	+	+
Lysine decarboxylase	+	+	-
Arginine dihydrolase	-	-	+
Ornithine decarboxylase	-	+	+
Glutamic acid decarboxylase	-	-	-
Motility	-	+	+

* Visible gas production within 48 hours.
** Visible gas production within 4 days.
*** Tested by method of Hormaeche and Munilla (5).
\+ Promptly positive.
\- Negative.
d Different biochemical types.

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DESIGNATION OF TYPES OF VIRUS TAXA

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Upon the recommendation of the Subcommittee on Nomenclature of the Viruses made to the fifth and sixth International Congresses of Microbiology it was agreed that no action relative to the formal approval of schemata for the nomenclature or classification of the viruses should be taken until the meeting of the seventh International Congress. However, there was no implication that free discussion of proposals for future names and classifications and certainly no suggestion that the type concept should be curtailed, nor that the type concept common to all of biology should be disregarded in virology.

Since the publication of Holmes' virus classification several classifications of viruses have appeared without the designation of nomenclatural types.

This communication is for the purpose of designating types for some of the genera and subgenera and proposing types for some suprageneric names where the names are not derived from the name of a genus. Since the Linnaean system of binomial nomenclature as now used is based on the types of the various taxa, the subsequent designation of types becomes necessary where not originally designated.

The legitimacy or appropriateness of these names is in no way implied by their inclusion here. In several cases their correctness can only be determined after designation of types.

In some cases these names were proposed in publications of very different classifications of viruses. Irrespective of the question of acceptance of these classifications, it would seem desirable for the convenience of all, that types be designated for these published names so that they can be brought into proper perspective with those of previously published taxa. It is important to differentiate between legitimacy of published names and acceptability in taxonomy, since nomenclature and taxonomy must be evaluated separately.

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Some type designations have already been made for some of these classifications by C.B. Philip. (Comments on the classification of the order Rickettsiales. Can. J. Microb. 2:261-270). The present communication deals with the following series of publications:

V.M. Zhdanov. Opred. Virusov. Chelov. i Zhivot, (Acad. Med. Sci. Moscow). 348 pp. 1953. (See also: Internatl. Bull. Bact. Nom. and Tax. 4:191-211. 1954.)
L.A. Zilber. Uchenie o Virusakh. 316 pp. 1956.
K.A. Sukhov. Virusy. 370 pp. 1956.
V.L. Ryzhkov. (in Kravchenko). Vopr. medits. Virus. pp. 9-19. 1950.
V.L. Ryzhkov. Mikrobiologiya 21:458-476. 1952.
V.M. Zhdanov and R.S. Korenblit (Korenblut). Zhurnal Microb. Epid. i Immuno-biol. 9:40-44. 1950.

The classification of Zhdanov and Korenblit, presented at a scientific conference in 1949, was set into page proof for the September 1950 issue of the Journal, but that issue seems never to have appeared and the "reprints" of it seem to consist merely of page proof. Since an effective publication is generally regarded to be a publication which has become available to the general public, the effective date for many of the names listed by Zhdanov and Korenblit coincides with the effective date of the Zhdanov 1953 publication in which the names are cited. Thus the family names based on Microvirus, Hepatophilus, Neurophilus, and Microvirus were not effectively published since they were not included in the September 1953 publication. The genera Pestigenes, Maculigenes, Hepatophilus, Viscerophilus, Neurophilus, and Microvirus were published by Zhdanov in 1953 in synonymy, and are therefore of questionable availability from the viewpoint of effective publication. Types are designated for these genera by the present writer so that they may be evaluated with more precision, inasmuch as they are in the virological literature. This seems particularly desirable in this case since very often names which have been presented in scientific conferences are treated in Russia as though they had been published, so that these names may well be expected to appear in printed Russian literature.

The author tried in vain for many months to obtain a copy of the Zhdanov and Korenblit publication. The writer

is, therefore, particularly grateful to Dr. Francis O. Holmes for permission to consult his "reprint" of this classification and for a photostatic copy of it.

Six genera published in 1953 by Zhdanov (Vyschellesskyella, Myelophilus, Myophilus, Dermaphilus, Apioles, and Plasmophila) were monotypic, as were six published in 1950 by Ryzhkov (Kappa, Meningophilus, Flageliophorus, Botkinia, Neurotropus, and Löffleria). In one case the diagnosis of the genus Glandulophilus as used in the 1950 Zhdanov and Korenblit article is quite different from that indicated for it in the 1953 Zhdanov publication.

The names with which the current communication is concerned are presented in two lists. The first list is that of suprageneric taxa and their types. This list, in most cases, merely brings together the suprageneric names from the various publications and gives their obvious types; however, for thirteen of the suprageneric taxa (indicated by the underlined word "type" following each) the nomenclatural type is not clearly derived from that of an included taxon and no types had been designated. Inasmuch as nomenclatural types are clearly desirable for these thirteen taxa, suggested nomenclatural types are listed. The second list includes the names of genera and subgenera with proposed type species.

DESIGNATION OF TYPES FOR CERTAIN SUPRAGENERIC TAXA OF VIRUSES

Acarophilaceae Zhdanov, 1953 pp. 119, 274. Type genus: Encephalophilus Zhdanov and Korenblit ex Zhdanov

Aphidophilaceae Ryzhkov, 1952 p. 466. Type genus: Aphidophilus Ryzhkov (Aphidaephilaceae Sukhov, p. 264.)

Arthropodophilae Ryzhkov, 1950 pp. 14,15,16. Type order: Pantropiales Ryzhkov

Arthropodophiliales Zhdanov, 1953 pp. 115, 273. Type family: Insectophilaceae Zhdanov

Bacteriophagaceae Ryzhkov, 1952 p. 466. Type genus: Bacteriophagus Ryzhkov

Beijerenckiales Ryzhkov, 1952 p. 465. (Beijerinckiales?)
Type family: Crystallococcaceae Ryzhkov

Borrelinales Ryzhkov, 1950 pp. 15,16. Type family:
Borrelinaceae Steinhaus

Borreliotales Ryzhkov, 1950 pp. 15,17. Type family:
Borreliotaceae Holmes

Botkiniaceae Ryzhkov, 1950 p. 19. Type genus:
Botkinia Ryzhkov

Chlamydozoa Ryzhkov, 1950 pp. 14,15,17. Type order:
Chlamydozoales Ryzhkov

Chlamydozoaceae Chen ex Ryzhkov, 1950 p. 17. Type genus:
Chlamydozoon Ryzhkov

Chlamydozoales Ryzhkov, 1950 pp. 15,17. Type family:
Chlamydozoaceae Chen ex Ryzhkov

Cicadinaephilaceae Sukhov, 1956 p. 264. Type genus:
Liburniafilus Sukhov

Crystallobiotae Ryzhkov, 1950 pp. 14,15,16. Type order:
Borrelinales Ryzhkov

Crystallococcaceae Ryzhkov, 1952 p. 465. Type genus:
Crystallococcus Ryzhkov

Cycadinaefilaceae Sukhov, 1956 p. 264. Type genus:
Liburniafilus Sukhov

Dermaphilaceae Zhdanov, 1953 pp. 134,314. Type genus:
Dermaphilus Zhdanov

Enterophilaceae Ryzhkov, 1950 p. 19. Type genus:
Enterophilus Ryzhkov

Eucrystallinae Ryzhkov, 1952 p. 465. Type order:
Beijerenckiales Ryzhkov

Flageliophoraceae Ryzhkov, 1950 p. 19. Type genus:
Flageliophorus Ryzhkov

Gamaleiaceae Zhdanov, 1953 pp. 107,253. Type genus: Gamaleia Zhdanov

Gamaleiales Zhdanov, 1953. pp. 107,253. Type family: Gamaleiaceae Zhdanov

Gamaleyae Ryzhkov, 1950 p. 16. Type order: Gamaleyales Ryzhkov

Gamaleyales Ryzhkov, 1952 p. 466. Type family: Bacteriophagaceae Ryzhkov

Glandulophaceae Ryzhkov, 1950 p. 19. Type genus: Glandulophus Ryzhkov

Haematophilaceae Ryzhkov, 1950 p. 19. Type genus: Haematophilus Ryzhkov

Heterophagi Sukhov, 1956 p. 264. Type family: Acarophilaceae Zhdanov

Insectophilaceae Zhdanov, 1953 pp. 125,285. Type genus: Insectophilus Zhdanov

Latentiaceae Ryzhkov, 1950 p. 18. Type genus: Latens Ryzhkov

Leptomotropales Ryzhkov, 1952 p. 466. Type family: Leptomotropaceae Ryzhkov

Leptomotropaceae Ryzhkov, 1952 p. 466. Type genus: Leptomotropus Ryzhkov

Löffleriaceae Ryzhkov, 1950 p.16. Type genus: Löffleria Ryzhkov

Löffleriales Ryzhkov, 1950 pp. 15,16. Type family: Löffleriaceae Ryzhkov

Lysogenaceae Ryzhkov, 1952 p. 466. Type genus: Lysogenus Ryzhkov

Meningophilaceae Ryzhkov, 1950 p. 19. Type genus: Meningophilus Ryzhkov

Myelophagaceae Ryzhkov, 1950 p. 19. Type genus: Myelophagus Ryzhkov

Neuroryctaceae Moschovskiy, 1945 ex Zhdanov, 1953 pp. 80,218. Type genus: Neuroryctes Calkins

Neurotropaceae Ryzhkov, 1950 p. 17. Type genus: Neurotropus Ryzhkov

Neurotropales Ryzhkov, 1950 pp. 15,17. Type family: Neurotropaceae Ryzhkov

Pantropiaceae Ryzhkov, 1950 p. 16. (Pantropaceae?) Type genus: Pantropus Ryzhkov

Pantropiales Ryzhkov, 1950 pp. 15,16. (Pantropales?) Type family: Pantropiaceae Ryzhkov

Phagococcaceae Ryzhkov, 1952 p. 466. Type genus: Phagococcus Ryzhkov

Piesmaphilaceae Ryzhkov, 1952 p. 465. Type genus: Piesmaphilus Ryzhkov

Pneumophilaceae Zhdanov and Korenblit (1950 p. 43) ex Zhdanov, 1953 pp. 94,241. Type genus: Pneumophilus Zhdanov and Korenblit ex Zhdanov

Pneumotropiaceae Ryzhkov, 1950 p. 18. (Pneumotropaceae?) Type genus: Pneumotropus Ryzhkov

Pneumotropiales Ryzhkov, 1950 pp. 15,18. (Pneumotropales?) Type family: Pneumotropiaceae Ryzhkov

Polyedraceae Zhdanov, 1953 pp. 137,316. Type genus: Polyedra Zhdanov

Polyedrales Zhdanov, 1953 pp. 137,316. Type family: Polyedraceae Zhdanov

Polyvectaceae Zhdanov, 1953 pp. 127,299. Type genus: Polyvectus Zhdanov

Pseudocrystallinae Ryzhkov, 1952 p. 465. Type order: Borrelinales Ryzhkov

Quanjeriaceae Ryzhkov, 1952 p. 465. Type genus: Quanjeria Ryzhkov

Ribonucleoproteinales Sukhov, 1956 pp. 262,264. Type order: Virothricales Ryzhkov (Virotrichales?)

Rubeoloferaceae Ryzhkov, 1950 p. 19. Type genus: Rubeoloferus Ryzhkov

Sanguiphilaceae Zhdanov, 1953 pp. 134,312. Type genus: Sanguiphilus Zhdanov and Korenblit ex Zhdanov

Strongyloplasmaceae Zhdanov and Korenblit, 1950 p. 43, ex Zhdanov, 1953 p. 195. (Strongyloplasmataceae?) Type genus: Strongyloplasma Lipschütz

Strongyloplasmales Zhdanov, 1953 p. 194. (Strongyloplasmatales?) Type family: Strongyloplasmaceae Zhdanov and Korenblit ex Zhdanov

Thripsophilaceae Ryzhkov, 1952 p. 466. (Thripophilaceae?) Type genus: Thripsophilus Ryzhkov

Thymonucleoproteinales Sukhov, 1956 pp. 263,264. Type order: Borrelinales Ryzhkov

Thysanopteraphilaceae Sukhov, 1956 p. 264. No type.

Tumefaciaceae Zhdanov, 1953 pp. 89,226. (Tumefacientaceae?) Type genus: Tumefaciens Zhdanov and Korenblit ex Zhdanov

Tumoriferaceae Ryzhkov, 1950 p. 18. Type genus: Tumoriferus Ryzhkov

Virococcaceae Ryzhkov, 1952 p. 465. Type genus: Virococcus Ryzhkov

Virothricaceae Ryzhkov, 1950 p. 16. (Virotrichaceae?) Type genus: Virothrix Ryzhkov

Virothricales Ryzhkov, 1950 pp. 15,16. (Virotrichales?) Type family: Virothricaceae Ryzhkov

DESIGNATIONS OF TYPE SPECIES FOR CERTAIN GENERA AND SUBGENERA OF THE VIRUSES

Agalliaphilus Ryzhkov, 1952 p. 466. Type species: Agalliaphilus tuberosi Ryzhkov

Aphidophilus Ryzhkov, 1952 p. 466. Type species: Aphidophilus cucumeris Ryzhkov

Apioles Zhdanov, 1953 p. 322. Type Species, monotype: Apioles apis Zhdanov

Bacteriophagus Ryzhkov, 1952 p. 466. Type species: Bacteriophagus escherichia Ryzhkov

Botkinia Ryzhkov, 1950 p. 19. Type species, monotype: Botkinia hepatica Ryzhkov

Capsulatus Zhdanov, 1953, p. 320. Type species: Capsulatus cacoeciae Zhdanov

Cardiophilus Zhdanov, 1953 pp. 133,309. Type species: Cardiophilus mengo Zhdanov

Cerebrophilus Zhdanov, 1953 pp. 133,307. Type species: Cerebrophilus muris Zhdanov

Chlamydozoon Ryzhkov, 1950 p. 17 (non Halberstaedter and von Prowazek 1907). Type species: Chlamydozoon psittaci Ryzhkov

Crystallococcus Ryzhkov, 1952 p. 465. Type species: Crystallococcus tabaci Ryzhkov

Demyelinisator Zhdanov and Korenblit (1950 p. 43) ex Zhdanov, 1953 pp. 81,221. Type species: Demyelinisator vulpis Zhdanov and Korenblit ex Zhdanov

Dermaphilus Zhdanov, 1953 pp. 134,314. Type species, monotype: Dermaphilus pecoris Zhdanov

Encephalophilus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 pp. 119,274. Type species: Encephalophilus scotticus Zhdanov and Korenblit ex Zhdanov

Encephalotropus Ryzhkov, 1950 p. 19. Type species: Encephalotropus ovis Ryzhkov

Enterophilus Ryzhkov, 1950 p. 19. Type species: Enterophilus porci Ryzhkov

Febrigenes Zhdanov, 1953 pp. 126,293. Type species: Febrigenes pappatasii Zhdanov

Flageliophorus Ryzhkov, 1950 p. 19. Type species, monotype: Flageliophorus pseudopestis Ryzhkov

Gamaleia Zhdanov, 1953 pp. 107,253. Type species: Gamaleia suis Zhdanov

Glandulophilus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 p. 245. Type species, monotype: Glandulophilus parotidis Zhdanov and Korenblit ex Zhdanov in syn.

Glandulophilus Zhdanov, 1953 pp. 109,267. (non Zhdanov and Korenblit ex Zhdanov 1953, in syn.) Type species: Glandulophilus caviae Zhdanov

Glandulophus Ryzhkov, 1950 p. 19. Type species: Glandulophus hominis Ryzhkov

Graminevorus Ryzhkov, 1952, p. 465. Type species: Graminevorus tritici Ryzhkov

Haematophilus Ryzhkov, 1950 p. 19. Type species: Haematophilus anemiae Ryzhkov

Haemorrhagogenes Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 pp. 119,282. Type species: Haemorrhagogenes suis Zhdanov and Korenblit ex Zhdanov

Hepatophilus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 p. 265, in syn. Type species: Hepatophilus hominis Zhdanov and Korenblit ex Zhdanov in syn.

Hyalesthesophilus Sukhov, 1956 p. 264. Type species: Hyalesthesophilus soleneai Sukhov

Insectophilus Zhdanov, 1953 pp. 125,286. Type species: Insectophilus japonicus Zhdanov

Insectophilus subg. Neurophilus Zhdanov, 1953 pp. 125,286. Type species: Insectophilus (Neurophilus) japonicus Zhdanov

Insectophilus subg. Viscerophilus Zhdanov, 1953 pp. 126,291. Type species: Insectophilus (Viscerophilus) dengue Zhdanov

Kappa Ryzhkov, 1950 p. 18. Type species, monotype: Kappa paramaecii Ryzhkov

Kreizbergia Ryzhkov, 1952 p. 466. Type species: Kreizbergia pistaciae Ryzhkov

Latens Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,206. Type species: Latens herpetis Zhdanov and Korenblit ex Zhdanov

Latens subg. Latens Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,206. Type species: Latens (Latens) herpetis Zhdanov and Korenblit ex Zhdanov

Latens subg. Ulcerogenes Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,211. Type species: Latens (Ulcerogenes) ovium Zhdanov and Korenblit ex Zhdanov

Latentia Ryzhkov, 1950 p. 18. Type species: Latentia herpes Ryzhkov

Leptomotropus Ryzhkov, 1952 p. 466. Type species: Leptomotropus vaccinii Ryzhkov

Leucosoferus Zilber, 1956 p. 313. Type species: Leucosoferus avium Zilber

Liburniafilus Sukhov, 1956, p. 264. Type species: Liburniafilus gramini Sukhov

Löffleria Ryzhkov, 1950 p. 16. Type species, monotype: Löffleria equi Ryzhkov

Lysogenus Ryzhkov, 1952 p. 466. Type species: Lysogenus typhi Ryzhkov

Maculigenes Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 p. 257, in syn. Type species: Maculigenes morbillorum Zhdanov and Korenblit ex Zhdanov in syn.

Meningophilus Ryzhkov, 1950 p. 19. Type species, monotype: Meningophilus murinus Ryzhkov

Microvirus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 p. 314, in syn. Type species, monotype: Microvirus pecoris Zhdanov and Korenblit ex Zhdanov in syn.

Myelinophagus Ryzhkov, 1950 p. 19. Type species: Myelinophagus avium Ryzhkov

Myelophilus Zhdanov, 1953 pp. 132,304. Type species, monotype: Myelophilus hominis Zhdanov

Myelovirus Ryzhkov, 1952 p. 465. Type species: Myelovirus mengo Ryzhkov

Myophilus Zhdanov, 1953 pp. 133,310. Type species, monotype: Myophilus hominis Zhdanov

Neurophilus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 p. 279, in syn. (non Insectophilus subg. Neurophilus Zhdanov). Type species: Neurophilus choriomeningitidis Zhdanov and Korenblit ex Zhdanov in syn.

Neurotropus Ryzhkov, 1950 p. 16. Type species, monotype: Neurotropus hominis Ryzhkov

Pantropus Ryzhkov, 1950 p. 16. Type species: Pantropus dengue Ryzhkov

Papillomiferus Ryzhkov, 1950 p. 18. Type species: Papillomiferus leporis Ryzhkov

Paschenia Ryzhkov, 1950 p. 18. Type species: Paschenia hominis Ryzhkov

Pestigenes Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 pp. 246,253. in syn. Type species: Pestigenes newcastlei Zhdanov and Korenblit ex Zhdanov in syn.

Phagococcus Ryzhkov, 1952 p. 466. Type: Phagococcus escherichiae Ryzhkov

Piesmaphila Ryzhkov, 1952 p. 465. Type species: Piesmaphila europeus Ryzhkov

Plasmophila Zhdanov, 1953 p. 322. Type species, monotype: Plasmophila pieries Zhdanov

Pneumophilus Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 p. 242. Type species: Pneumophilus gripposus Zhdanov and Korenblit ex Zhdanov

Pneumotropus Ryzhkov, 1950 p. 18. Type species: Pneumotropus grippae Ryzhkov

Polyedra Zhdanov, 1953 p. 316. Type species: Polyedra bombycis Zhdanov

Polynosa Zhdanov, 1953 pp. 107,257. Type species: Polynosa morbillorum Zhdanov

Polyvectus Zhdanov, 1953. pp. 127,299. Type species: Polyvectus occidentalis Zhdanov

Quanjeria Ryzhkov, 1952 p. 465. Type species: Quanjeria tuberosi, Ryzhkov

Rubeoloferus Ryzhkov, 1950 p. 19. Type species: Rubeoloferus morbillorum Ryzhkov

Sanguiphilus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 pp. 134,312. Type species: Sanguiphilus equinus Zhdanov and Korenblit ex Zhdanov

Solanophilus Ryzhkov, 1952 p. 465. Type species: Solanophilus tuberosi Ryzhkov

Strongyloplasma subg. Borreliota Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,201. Type species:

Strongyloplasma (Borreliota) avium Zhdanov and Korenblit ex Zhdanov

Strongyloplasma subg. Strongyloplasma Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,196. Type species: Strongyloplasma (Strongyloplasma) variolae Zhdanov and Korenblit ex Zhdanov

Strongyloplasma subg. Varicella Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,204. Type species: Strongyloplasma (Varicella) varicellae Zhdanov and Korenblit ex Zhdanov

Strongyloplasma subg. Zoovariola Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 75,204. Type species: Strongyloplasma (Zoovariola) ovis Zhdanov and Korenblit ex Zhdanov

Thripsophilus Ryzhkov, 1952 p. 466. (Thripophilus?) Type: Thripsophilus lycopersici Ryzhkov

Tumefaciens Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 89,227. Type species: Tumefaciens ranae Zhdanov and Korenblit ex Zhdanov

Tumoriferus Ryzhkov, 1950 p. 18. Type species: Tumoriferus avium Ryzhkov

Tumoroides Zilber, 1956 p. 313. Type species: Tumoroides myxomae Zilber

Virococcus Ryzhkov, 1952 p. 465. Type species: Virococcus cucurbitae Ryzhkov

Virothrix Ryzhkov, 1950 p. 16. Type species: Virothrix hominis Ryzhkov

Viscerophilus Zhdanov and Korenblit, 1950 p. 44 ex Zhdanov, 1953 p. 293, in syn. (non Insectophilus subg. Viscerophilus Zhdanov). Type species: Viscerophilus pappatasii Zhdanov and Korenblit ex Zhdanov in syn.

Vyschelesskyella Zhdanov and Korenblit, 1950 p. 43 ex Zhdanov, 1953 pp. 81,224. Type species, monotype: Vyschelesskyella equina Zhdanov and Korenblit ex Zhdanov

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VII INTERNATIONAL CONGRESS FOR MICROBIOLOGY

The VII International Congress for Microbiology, under the auspices of the International Association of Microbiological Societies (IAMS) organized by the Swedish Microbiological Society, will meet in Stockholm, Sweden, 4-9 August, 1958. Meetings of the international committees and subcommittees are scheduled as follows:

Thursday 31st July	Judicial Commission
Friday 1st August	Judicial Commission
Friday 1st August	International Committee on Bacteriological Nomenclature
Saturday 2nd August	Judicial Commission
Saturday 2nd August	Subcommittee on Enterobacteriaceae
Saturday 2nd August	Subcommittee on Viruses
Saturday 2nd August	Subcommittee on Streptococcus
Monday 4th August	International Committee on Bacteriological Nomenclature
Tuesday 5th August	Judicial Commission
Thursday 7th August	Subcommittee on Enterobacteriaceae
Friday 8th August	Subcommittee on Leptospira

It is urged that all members of the Judicial Commission and of the International Committee be in Stockholm sufficiently in advance of the formal opening of the International Congress to participate in the meetings as scheduled above.

The revised International Code of Nomenclature of the Bacteria and Viruses will be published in June, 1958. The appearance of the revised codes for botany and for zoology now make possible a critical examination of our Bacteriological Code. It is possible that some action may be taken by the International Union of Biological Sciences at its July meeting in London to bring about better coordination in terminology. It is unfortunate that the three codes, in some places, use different and, in some cases, conflicting terminologies.

A full list of agenda will be presented for action by the Judicial Commission and by the International Committee.

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LETTERS TO THE EDITOR

The Editor
International Bulletin of Bacteriological Nomenclature

Your publication of the system of classification proposed by Tesić (1957) offers an occasion for restating two propositions of prime importance in relation to classification, which are often ignored by bacterial systematists. These are:

1. That groups of similar status should be defined always by comparable criteria.

2. That criteria of classification can be applied correctly only when adequate information upon the specific point is available.

In Tesić's classification the first of these principles is violated, in that Orders I, II, III, VI are defined on morphological, and IV, V, on physiological grounds. The effect is that the dubiously autotrophic iron bacteria are classified as autotrophs, whereas the photosynthetic and nitrifying genera are included with morphologically similar heterotrophs. The non-iron chlamydobacteria are ignored in this arrangement.

The second principle is also violated in many cases where superficial and superseded morphological descriptions are accorded great weight. For example, streptococci and lactobacilli are placed in separate families because the first is "spherical" the second, "rod-shaped", whereas both are now known to consist of filaments and chains of very small cells. No distinction is drawn between "rod-shaped" bacteria which are elongated single cells and those which are septate filaments, since both are regarded as typically eubacterial. The Actinomyces and Streptomyces are not distinguished.

In these cases, and many others which might be quoted, this classification perpetuates or even reintroduces errors which have been or are in process of being rectified in other proposed systems.

It is my own opinion that, as in other biological disciplines, bacteria may readily be classified throughout upon

morphological grounds (Bisset, 1952), and that much of the confusion which still exists, for example, very notably in the case of the autotrophs, is due almost entirely to lack of study (Bisset and Grace, 1954). Thus the primary requirement for an improved bacterial classification is that those who interest themselves in the problem should apply themselves to the elucidation of the problems of bacterial morphology, much of which is quite unexamined.

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November 8, 1957

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_____ and J.B. Grace. 1954. The nature and relationships of autotrophic bacteria. 4th Symposium: Autotrophic microorganisms. Soc. Gen. Microbiol. Cambridge University Press.

Tesić, Z.P. 1957. A simplified system of bacterial classifcation. Internatl. Bull. Bact. Nom. Tax. 7:117.